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Evaluating the Total Cost of Ownership for an On-Premise Application System

As cloud computing and technologies continue to evolve, more organizations are evaluating cloud platform features, functionality, and operational costs against those of on-premise applications to understand the optimal approach for hosting enterprise applications. Forrester forecasts that the global market for cloud computing will grow from $40 billion to more than $241 billion in the next ten years.[1] Characterized as cost effective, flexible and secure, cloud applications can help organizations bring products and services to market more rapidly than ever before.

Cloud service offerings are especially valuable for small and medium sized businesses (SMBs) who have limited capital expense budgets and have difficulty predicting future usage and business needs. Leveraging technologies and applications via a Software-as-a-Service (SaaS) model enable SMBs to reduce or maintain operating expenses while offering products and services that compete with larger organizations. Forrester estimates that 80 percent of IT spending is on maintenance and only 20 percent is geared toward new projects and initiatives.[2] Cloud applications help organizations liberate their personnel from the daily tasks of managing an IT infrastructure, allowing them instead to focus on core business capabilities and strategic initiatives that will help them to achieve real corporate goals and objectives. Organizations can take advantage of low or no initial setup costs and pay monthly or annual fees for cloud services based on usage and business need, instead of purchasing, deploying, and maintaining an IT infrastructure or enterprise software system.

Accurately comparing the total cost of ownership (TCO) of a cloud versus an on-premise application system can be challenging. Models often fail to capture an accurate cost because they only compare the initial purchase price of hardware and software for an on-premise solution to the subscription fees of a cloud solution. A true cost comparison should also include ongoing costs to operate, maintain, and upgrade a

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system over its lifetime (typically seven to ten years). And, many models fail to capture the personnel cost associated with operating and maintaining an on-premise application system. Lastly, there are several intangible benefits of cloud computing that should also be measured and considered. The goal of this whitepaper is to help organizations perform a comprehensive comparison between a cloud and on-premise solution by exploring the key benefits of a cloud solution and by presenting a framework for estimating and comparing the total cost of ownership for both approaches.

SaaS Adoption Drivers

Cloud computing growth and adoption have been driven by customers looking for reduced implementation costs, predictable operating expenses, enhanced flexibility and scalability in enterprise application software platforms, and risk mitigation for system downtime. Gartner expects SaaS to become the dominant deployment and licensing model for policy administration systems over the next ten years.[3] The strong growth in SaaS and cloud computing is expected to continue to rise mainly because organizations are increasingly looking for IT investments that enable stronger revenue growth and profitability. Gartner predicts IT costs will decrease as a result of the increased adoption of cloud computing. Cloud computing will help more organizations shift their focus from internal capital and operational expenses to IT visioning, service provisioning and relationship management.

SaaS Adoption Inhibitors

However, these benefits offered by cloud computing are sometimes not enough to persuade many organizations to move to the cloud. Organizations will host their system on-premise because of concerns about security and regulatory compliance, system and environment control, and system performance and availability. A closer examination of each of these inhibitors to adoption shows that most of these concerns can be addressed by new innovations in cloud computing.

Security and Compliance

IT managers are most concerned with the ability to secure company data in a cloud environment and to comply with corporate, state or board regulatory standards. The fears are based on the fact that the software's multi-tenant architecture is housed in a datacenter outside an organization's firewalls. A security breach can be catastrophic if confidential information is stolen or made public. While the security concerns are valid, several providers have made significant investments to implement systems that safeguard corporations' data. Cloud providers, like Amazon and Google, have addressed security concerns by investing heavily in security and compliance architecture development, advancing the security and compliance standards across the industry. Current cloud providers offer security in the following layers:

- Physical layer – restricted access to facility, surveillance, monitoring, and alarm systems
- Network layer – comprehensive firewalls and TLS/SSL encryption for network data transmissions
- Application layer – restricted access to databases, authentication, and security tools for monitoring malicious events, threats, and intrusion attempts

Certifications and audits (i.e. SSAE 16 / SAS 70 / SOC1 / ISAE 3402) mitigate the risk taken by organizations when using cloud services by establishing security and compliance standards industry wide. A cloud provider that operates within a SAS 70 Type II / SSAE 16 facility has a high level of commitment to maintaining controls and processes to ensure reliability and security for its customers. Organizations should always seek additional risk mitigation in contractual protection that ensures providers adhere to strict security standards and guidelines.

Control

Organizations are hesitant to relinquish control of their data to cloud providers because of concerns about data ownership, data access, and compliance with regulations. However, most current cloud providers will allow differing levels of customer control and access by providing organizations with the ability to manage trust, authentication, and authorization to data4 . Customers have the least control over their data and resources in a SaaS model where the cloud provider manages the physical assets and the configuration of the application, but even in a SaaS model providers can offer greater degree of customer control and access to the underlying infrastructure, platform, and application. Table 1 provides a summary of the various cloud models and the control customers are offered under each model.

	Software-as-a-Service (SaaS)	Platform-as-a-Service (PaaS)	Infrastructure-as-a-Service (IaaS)
Definition	Cloud provider installs and operates the application software in the cloud where users can access the software from cloud clients.	Cloud provider offers a computing platform including OS, programming language execution environment, database, and web server where developers develop and run software.	Cloud provider offers the physical infrastructure including virtual machines, servers, storage, load balancers, network, and datacenter space with power and cooling.
Control	• Provider controls underlying infrastructure • Provider controls over the configuration of their application	• Provider controls underlying infrastructure • Customer controls over the configuration of their application	• Provider controls the physical assets • Customer controls all other aspects of infrastructure
Examples	• Salesforce.com • Google Apps • Microsoft Office 365 • Workday	• Microsoft Azure • Google App Engine • Heroku • Force.com	• Amazon Web Services (AWS) • Rackspace • Go-Grid • OpenStack

Table 1: Cloud Models and Customer Control

Performance and Availability

Due to the nature of competition and the maturity of the technologies, cloud service providers are continually seeking ways and approaches to maintain high availability (uptime) and greater performance. Majority of cloud providers offer at least 99.5 percent in their service level agreements (SLAs). Providers such as Google guarantee uptime of 99.9 percent in their SLAs. The scale and expertise of cloud providers offer stability and performance that is difficult to match in an on-premise environment. Organizations can thus hedge the risk of downtime and loss of revenue by leveraging cloud services and passing the risk onto the providers.

Total Cost of Ownership (TCO)

As mentioned earlier, organizations commonly error in comparing ongoing cloud subscription costs to only the initial cost of an on-premise system without accounting for the ongoing cost to maintain and upgrade a system over the application's lifetime. According to Gartner, the annual cost to own and manage software applications can be up to four times the cost of the initial purchase.[5]

A TCO Estimation Framework for On-Premise Application Systems

The following framework provides a process and approach that can help organizations perform a comprehensive cost comparison that captures both the upfront and recurring costs for an on-premise application system.

The framework identifies five phases required to successfully implement and manage an on-premise system. Organizations can use this framework to better structure their cost estimation process and make sure they do not overlook any hidden costs. The framework provides the key activities, cost drivers, and recommendations for each phase to help execute an on-premise cost estimate.

	Design	Build	Deploy	Maintain	Upgrade
Key Activities	• Identify core business requirements • Identify datacenter, hardware, and software requirements based on business requirements • Identify personnel that will be responsible for system, network, and database administration	• Purchase required hardware and software including servers, storage, and network equipment • Select datacenter that will meet power, space, and cooling requirements • Select internet provider that will meet bandwidth requirements	• Setup, install, and test new system including hardware, software, and datacenter • Train staff on using and maintaining system • Migrate data from old system to new system	• Identify personnel responsible for ongoing support and operations of system Provide ongoing support and training for • system Perform monitoring, diagnostics, testing, • analytics, and tuning on system	• Identify changes to core business requirements • Review existing hardware and software and perform gap analysis • Upgrades existing hardware and software based on business requirements
Cost Drivers	• Time and effort to identify business requirements • Time and effort to design the infrastructure architecture • Consultant fees for infrastructure design and planning	• Time and effort to assess and select hardware, software, and datacenter • Time and effort to review license agreements, service level agreements (SLAs), and security requirements • Software and hardware upfront costs	• Time and effort to setup, install, and test system • Training for users and administrators • Data migration related costs	• Time and effort to administer, manage, and support system • Hardware maintenance and software assurance • Datacenter - power, cooling, space, and internet bandwidth	• Time and effort to implement upgrades • Infrastructure hardware and software upgrade costs • Application software upgrade costs
Recommendations	• Plan for flexibility, scalability, and future growth by designing architecture with excess capacity • Minimize downtime by including a redundant site for disaster recovery • Use business specific data to estimate infrastructure requirements (users per server, storage per transaction)	• Perform an apples-to-apples comparison of your planned infrastructure to your cloud provider • Negotiate with vendors and purchase required hardware and software • Select datacenter and internet provider that is comparable to cloud provider	• Include adequate budget for training users and administrators • Include time and effort for testing and tuning the system prior to deployment • Include time and effort for launch activities, awareness, and pilots	• Account for annual hardware maintenance and software assurance (20% of the initial cost) • Use industry benchmarks and comparables to estimate personnel required • Account for cost of compliance and audit requirements (SAS 70 / SSAE 16)	• Use a 3 year refresh cycle for hardware and software and 3 year straight-line depreciation • Use a 5-10 year model when estimating the total cost of ownership • Apply the industry average discount rate (WACC) and apply discount rate for future hardware purchases
	Upfront Costs			Recurring Costs	

Upfront Costs

The design, build and deploy phases account for the upfront costs an organization can expect before going live with a new application system. Upfront capital investment significantly impacts the return on investment (ROI) and payback period. On-premise deployments require significant upfront costs.

Design

Organizations need to start by estimating the amount of time that will be required to collect core business requirements and to design a physical infrastructure to support those requirements. If expertise on infrastructure design is not available internally, consultants will be required. Expertise is required to design an infrastructure that will support the business needs and the future growth of the organization. Industry metrics and benchmarks should be used to estimate the number and type of servers, amount of storage, amount of bandwidth, and the datacenter power, cooling, and space requirements. IDC estimates that on average one server will support 200 users.[6] If industry benchmarks and metrics are not available, consider using internal data from existing systems. Historical data can be used to estimate future requirements.

Flexibility and scalability also must be addressed in the design phase. On-premise models take time to scale and upgrade so additional capacity must be planned for ahead of time. Scaling out and scaling up both present challenges. Many enterprise architectures are designed to support scaling up to more powerful servers rather than scaling out to a larger number of servers. Changing an architecture to support scaling out can be very expensive and in some cases is impossible. Scaling out will also in some cases increase software licensing and datacenter costs.[7]

Most importantly, many organizations fail to include disaster recovery in their estimation. To compete with a cloud solution, an on-premise environment must offer redundancy, offsite backups, and a redundant site for disaster recovery. The disaster recovery site will require comparable servers, network hardware, software, and datacenter to those utilized in the primary site.

Build

The infrastructure design will dictate the upfront capital investment required. The cost comparison should account for the same performance and quality level that would be available through the cloud for all components of the infrastructure including application servers, database servers, network hardware, software, bandwidth, and the datacenter power, cooling, and space.

Cost to build a physical infrastructure and a redundant disaster recovery site are key areas where cloud providers have a stronger advantage. Not only do cloud providers realize significant economies of scale, but they may also leverage volume discounts with hardware and software vendors and datacenter and internet providers because of the magnitude and frequency of purchases. Lastly, building the infrastructure will require significant time and effort to evaluate all available options and to negotiate the proper purchase price with vendors.

Deploy

Deploying the physical infrastructure will require significant time and effort to setup, install, test, and tune prior to going live. When estimating the time and effort to deploy a new system, data migration from the old system should also be included. Finally, training costs associated with learning and administering the new system, network, and database should be considered. The speed at which a cloud provider can deploy a new application is difficult to match under a self-hosted scenario.

Recurring Costs

The costs to design, build, and deploy a system are only the upfront costs, which are a small fraction of the total costs and operating expenses to support the enterprise application. The ongoing maintenance and administration of the system account for the majority of the costs, and as we found, continuous upgrades will also require significant ongoing investments of time and effort.

Maintain

The purchased hardware and software require ongoing support and maintenance, approximately 20 percent of the upfront cost per year. Amazon Web Services (AWS) estimates the ongoing cost of maintenance to be 18 percent to 22 percent.

The bulk of maintenance costs are generated from the time and resources required to manage the system. Cloud providers offset this cost to customers by offering resources dedicated to maintenance, support, and operations. At a minimum, one system administrator, one network administrator, and one database administrator are required for organizations who self-host. Support responsiveness to business needs could be significant (24 hours a day, most of the year for example) so the personnel required to support the system should not be underestimated. Additional business requirements like daily, weekly, and monthly operation tasks and system security and regulatory compliance management should also be considered when estimating run costs. Cloud provider's SLA should be reviewed for a comprehensive understanding of all the dedicated personnel that are required.

After determining the number of full time employees required for each role, the average fully loaded salary for each role can be used to estimate the ongoing personnel expense. Ongoing cost of personnel should not be underestimated or overlooked as this is the largest component of the cost for an on-premise system.

Upgrade

Most hardware and software has about three to five years of useful life. Frequent and automatic upgrades are included in a traditional cloud model. It is recommended to use 3 years for the hardware and software refresh cycle to keep up with the latest technologies. That means every 3 years additional time and effort will be required to reassess the core business requirements and upgrade the infrastructure hardware and software. The cost to re-implement and upgrade to new versions of the application and underlying infrastructure is typically included in cloud service offerings.

All hardware and equipment purchased should be depreciated over its useful life and the tax benefit of the hardware depreciated should be accounted for when assessing the cost model. Additionally, organizations should use their discount rate or industry average discount rate to discount the costs expected in future periods. The TCO and ROI comparison of a cloud and on-premise application system should be over seven to ten years, which is the typical lifetime of a major application system.[8]

Intangibles

After completing the cost comparison between a cloud and on-premise system using the framework above, there are several intangibles that should be considered and accounted for in the model. These benefits and features of cloud computing are more difficult to quantify. Table 2 below identifies the key intangibles and recommendations on how to address the intangibles when estimating costs.

When evaluating the intangibles, consider opportunity costs related to downtime including lost productivity and time and effort required for remediation and the business risks including loss of revenue, SLA liabilities, and loss of goodwill. In a cloud computing model, these risks are passed onto the cloud provider. Cloud providers offer high availability to minimize hardware failure, natural disasters, network failure, and human errors. To account for the value of reduced risk, add an additional section to TCO model to address the risk value. To estimate the value of the risk mitigation offered by cloud providers, estimate the probability of each event and the cost of each event. The formula for the total value of risk is as follows:

Risk Value = $\sum$ (Probability of Event x Cost of Event)

	Risk Mitigation	Security	Flexibility and Scalability	Opportunity Cost
Description	Hedge against downtime, loss of revenue, and damage to brand reputation by transferring risk and accountability for system uptime to cloud provider	Comprehensive security policy of cloud provider including firewalls, encryption, monitoring, anti-virus and anti-intrusion software	Ability to scale resources up and down including processing power, memory, storage, and bandwidth to meet unexpected demand, support growth and improve time to market	Value of the best alternative forgone for the time and money spent on self-hosting including personnel and capital expenditures that comes at the expense of other projects and initiatives
Recommendations	• Compare service expected for self-hosting with the cloud provider's SLA • Estimate the cost of a redundant infrastructure • Estimate the revenue loss from downtime	• Compare internal security to cloud offering • Estimate the cost of maintaining compliance and audit requirements • Estimate the cost of monitoring, alarms, surveillance for datacenter, and software (monitoring, anti-intrusion, anti-virus)	• Estimate the additional cost of an infrastructure to support additional capacity • Estimate the cost of hardware and personnel time to support scalability • Account for potential loss of business due to slower time to market and poor performance	• Estimate revenue loss from not pursuing other projects and initiatives • Estimate the cost of delaying new product or service releases • Perform study to evaluate projects impacted by pursuing a self-hosted model

Table 2: Intangibles and Recommendations for Cloud Cost Estimation

Conclusion

A true cost comparison between cloud and on-premise application systems reveals that cloud is more cost effective for various organization types and sizes, especially for SMBs. The most significant component of the TCO for on-premise application systems is the ongoing cost of personnel to monitor, maintain, support, and upgrade the system. These costs can be between 50 percent and 85 percent of the total costs of the application.[9] IDC reviewed several SaaS versus traditional deployments and found that when the cost of personnel and upgrades is taken into consideration, the break-even point may never be realized.[10] Organizations of all sizes can benefit significantly from utilizing cloud services when taking into account the benefits, costs, and key intangibles: flexibility, scalability, security, and risk mitigation. Cloud computing growth is expected to continue because it helps reduce upfront capital expenditures, improve ROI, reduce the investment payback period, speed up deployments, and improve application agility. In an increasingly agile business environment, cloud services accelerate the pace of innovation by shifting an organization's resources and focus from infrastructure management to the organization's core competencies.

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Marcin S. Grobelny is a Management Consultant at Kenny & Company and has over seven years consulting experience. Marcin has led projects relating to process improvement and optimization, business strategy, and has performed cost and schedule forensics on disputes, claims, and distressed projects. Marcin holds a Bachelor's of Science in Managerial Economics from the University of California, Davis and a Master's of Business Administration from University of California Berkeley's Haas School of Business.

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